

CLAIMS

1. A device for protecting medical apparatus, comprising:

a hollow body having at least three portions, in which:

5 a first end portion has a first tubular connector, destined to be connected with a fluid line which fluid line is during operation of the device connected to an extracorporeal circuit for transport of fluid;

10 a second end portion, opposite the first end portion has a second tubular connector, in fluid communication with said first tubular connector by means of a cavity which is internal of said hollow body, and destined to be connected to a fluid line which fluid line is during operation of the device connected to a medical apparatus; and

15 a third intermediate portion, interpositioned between the first end portion and the second end portion, which third intermediate portion is coupled at a first side thereof to said first end portion along at least a first union zone, and which third intermediate portion is coupled at a second side thereof, opposite to the first side thereof, to said second end portion
20 along at least a second union zone;

at least two filter membranes in which:

25 a first membrane, contained in said hollow body, defines, in said cavity, a first gas-permeable anti-contamination barrier, arranged transversally between said first end portion and said third intermediate portion;

a second membrane, contained in said hollow body, defines, in said cavity, a second gas-permeable anti-contamination barrier, arranged transversally between said second end portion and said third intermediate portion.

5 **2.** The device of claim 1, wherein said third intermediate portion is plate-shaped and has a central opening.

3. The device of claim 1, wherein said third intermediate portion is made in a single piece.

10 **4.** The device of claim 1, wherein said third intermediate portion is made of a rigid material.

5. The device of claim 1, wherein said third intermediate portion is integrally moulded in plastic material.

6. The device of claim 1, wherein said first union zone and said second union zone are permanent coupling zones.

15 **7.** The device of claim 6, wherein said first union zone and said second union zone are zones subjected to ultrasonic welding.

8. The device of claim 1, wherein:

20 said first end zone exhibits an internal surface, which delimits said cavity and which faces said first membrane, from which internal surface a plurality of reliefs emerges, defining a striker surface for said first membrane;

 said second end portion exhibits an internal surface, which delimits said cavity and which faces said second membrane, from

which internal surface a plurality of reliefs emerges, defining a striker surface for said second membrane;

said third intermediate portion exhibits two internal surfaces which delimit said cavity;

5 a plurality of reliefs emerges from a first of said two internal surfaces, which first internal surface faces said first membrane, which plurality of reliefs defines a striker surface for said first membrane;

10 a plurality of reliefs emerges from a second of said two internal surfaces, which second internal surface faces the second membrane, which plurality of reliefs defines a striker surface for said second membrane.

9. The device of claim 8, wherein said pluralities of reliefs are ribs arranged tangentially, with reference to a longitudinal axis of the hollow body, defining a plurality of tangential channels, communicating with a central zone of said cavity, by means of one or more radial channels defined by said pluralities of reliefs.

10. The device of claim 1, wherein said first union zone and said second union zone are annular and preferably coaxial to one another.

11. The device of claim 1, wherein said first membrane and said second membrane are at least partially facing one another.

12. The device of claim 1, comprising at least a first annular seal zone and a second annular seal zone, located at a perimeter edge of the first membrane and, respectively, at a perimeter edge of the second

membrane.

13. The device of claim 12, wherein said first annular union zone and said second annular union zone exhibit radial dimensions of about a same size and of a greater size than radial dimensions of the first annular seal zone and a second annular seal zone.
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14. The device of claim 1, wherein said first membrane and said second membrane each exhibit at least one straight perimeter side.
15. The device of claim 14, wherein said first membrane and said second membrane each exhibit at least a first pair of perimeter sides which are opposite and parallel to one another.
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16. The device of claim 15, wherein said first membrane and said second membrane each exhibit at least a second pair of perimeter sides which are opposite and parallel to one another.
17. The device of claim 16, wherein said first membrane and said second membrane each exhibit a rectangular shape.
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18. The device of claim 12, wherein said first annular seal zone and said second annular seal zone each exhibit at least two joined adjacent sides which exhibit a rounded corner.
19. The device of claim 18, wherein said first annular seal zone and said second annular seal zone each exhibit a rectangular shape, with rounded corners.
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20. A device for protecting medical apparatus, in particular from contamination by infectious agents, comprising:

a hollow body having at least two portions, in which:

5 a first portion has a first tubular connector, destined to be connected with a fluid line which fluid line is during operation of the device connected to an extracorporeal circuit for transport of fluid;

10 a second portion has a second tubular connector, in fluid communication with said first tubular connector by means of a cavity which is internal of said hollow body, and destined to be connected to a fluid line which fluid line is during operation of the device connected to a medical apparatus, said second portion being solidly connected to said first portion;

15 at least one membrane, contained in said hollow body and defining in said cavity, a gas-permeable anti-contamination barrier, arranged transversally between said first tubular connector and said second tubular connector, said at least one membrane exhibiting a perimeter edge having a predetermined shape; a maximum possible circle which can be drawn inside the perimeter edge having an area which is smaller than an area of a surface of
20 the at least one membrane.

21. The device of claim 20, wherein said at least one membrane has at least one perimeter side having a degree of curvature which is greater than a lateral dimension of the at least one membrane, the lateral dimension being considered in a perpendicular direction to
25 said perimeter side.

22. The device of claim 21, wherein said perimeter side is straight.

- 23.** The device of claim 22, wherein said at least one membrane exhibits at least a first pair of perimeter sides which are opposite, straight and parallel to one another.
- 24.** The device of claim 23, wherein said at least one membrane exhibits at least a second pair of perimeter sides which are opposite, straight and parallel to one another.
- 25.** The device of claim 24, wherein said at least one membrane exhibits a rectangular shape.
- 26.** The device of claim 20, comprising at least one annular seal zone, located at a perimeter seal edge of said at least one membrane and exhibiting at least two adjacent perimeter sides which are joined by a rounded corner.
- 27.** The device of claim 26, wherein said annular seal zone exhibits a rectangular shape with rounded corners.
- 28.** The device of claim 20, wherein at least one of said first portion and said second portion exhibits a flanged part, to which said at least one filter membrane is associated, which flanged part exhibits a shape which is delimited by a perimeter edge; a maximum diameter circle which can be drawn within said perimeter edge having an area which is smaller than a surface area of said flanged part.
- 29.** The device of claim 28, wherein the shape of said perimeter edge of said flanged part corresponds to a shape of said perimeter edge of said at least one membrane, and is external thereof.
- 30.** An auxiliary line of an extracorporeal circuit comprising at least

one tube having at least a first end communicating with the extracorporeal circuit and a second end associated during operation of the auxiliary line to a medical apparatus, the tube being provided with at least one device made according to claim 1, or to claim 20.

31. The auxiliary line of claim 30, wherein said at least first end of said tube opens into a container for a fluid, which container is part of said extracorporeal circuit.

32. The auxiliary line of claim 30, wherein said second end is predisposed to be connected to an operator unit of said medical apparatus.

33. The auxiliary line of claim 30, wherein said second end is predisposed to be connected to an apparatus for extracorporeal treatment of blood.

34. An extracorporeal circuit comprising an auxiliary line as in claim 30.

35. A manufacturing process of a device for protecting medical apparatus, comprising stages of:

preparing three portions of a hollow body in which:

a first portion has a tubular connector destined for connection with a fluid line connected during operation to an extracorporeal circuit for fluid transport;

a second portion has a second tubular connector, destined to be set in fluid communication with said first tubular

connector, through a cavity afforded internally of said hollow body, and further destined to be connected with a fluid line which during operation is connected to a medical apparatus; and

5 a third portion, plate-shaped and affording a central opening, has on a side thereof at least a first union zone predisposed for union with a corresponding union zone afforded in the first portion and on the opposite side, at least a second union zone, predisposed for union with a corresponding union zone
10 located on the second portion;

preparing two filter membranes which are each able to define a gas-permeable anti-contamination barrier in the cavity;

grouping said three portions and said two membranes, said third portion being interpositioned between said first and second end
15 portions, one of the two membranes being arranged transversally between the first and the third portion, another of the two membranes being arranged transversally between the third and the second portion, the first and second union zones of the third portion meeting with corresponding union zones of the first and
20 second end portions;

solidly uniting said three portions and said two membranes by a simultaneous solid connection, operating along the union zones.

36. The process of claim 35, wherein said stage of grouping includes interpositioning the perimeter seal edges of the first membrane and
25 the second membrane between annular seal zones which face one another and are borne on the first portion and the third portion and,

respectively, on the third portion and the second portion.

37. The process of claim 35, wherein said simultaneous solid connection comprises an ultrasonic welding process for obtaining the solid connection.
- 5 38. The process of claim 35, wherein said simultaneous solid connection comprises a compression of the union zones.